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FOREST INSECT AND DISEASE CONDITIONS IN THE PACIFIC NORTHWEST

July 1979

Compiled by:

OREGON STATE DEPARTMENT OF FORESTRY

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

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INTRODUCTION

Damage by forest insects and diseases was detected and recorded during aerial and ground surveys made cooperatively by personnel from the USDA-Forest Service, the Oregon State Department of Forestry, and Washington State Department of Natural Resources. Ground surveys were conducted to verify aerial survey findings, evaluate stand conditions, make biological evaluations, monitor insect and pathogen populations, and collect prevention and presuppression data necessary for control decisions. The volume of timber killed by bark beetles was estimated from dead tree counts made during aerial surveys. Volume losses resulting from defoliators, sucking insects, Ips engravers and diseases were not estimated.

INSECT CONDITIONS IN BRIEF

Spruce budworm defoliation decreased dramatically in Oregon and Washington. The area defoliated in Oregon on the Warm Springs Indian Reservation was one-third that of last year's defoliation. In Washington, the area of visible defoliation was less than one-fifth of the area defoliated last year. However, poor weather conditions during the 1978 aerial survey precluded accurate detection of defoliation caused by the western spruce budworm in Washington.

Bark beetle activity increased in Washington and decreased in Oregon in 1978. The mountain pine beetle continued to cause extensive tree mortality in lodgepole and ponderosa pine stands. Western pine beetle losses in mature ponderosa pine stands more than doubled in central and southwest Oregon. Losses caused by the Douglas-fir beetle declined in both States.

DISEASE CONDITIONS IN BRIEF

Root diseases continued to be among the most serious problems affecting forest productivity in the Region. Almost no change in root disease incidence occurs from year to year. However, several new black stain root disease centers were detected in western Oregon and Washington in 1978. The Washington State Department of Natural Resources is moving cautiously into direct control of Armillaria and laminated root rots.

Annosus root and butt rot was found causing decay in up to 30 percent of the western hemlock stems in rotation age (50-80 year) stands. More infection was found in thinned than in unthinned stands. However, a University of Washington survey showed that an average of 38 percent of the trees in 21 young, unthinned hemlock stands were infected by *Fomitopsis annosa*.

Moist spring weather favored growth of needle diseases on western larch in northeast Washington. Leaf curling and browning were highly visible throughout the range of big leaf maple. Causes of the maple malady include a leaf disease, anthracnose, lingering effects of the 1977 drought, and heavy seed crops.

Limited surveys of advanced white fir regeneration indicated that up to 22 percent of such trees were infected by the Indian paint fungus.

Dutch elm disease has not been reported in any Washington communities except Walla Walla. There have been no new reported findings in Oregon. No infected trees were detected in Portland in 1978.

Charcoal root disease was found killing Douglas-fir seedlings in an Umpqua, Oregon nursery. This potentially serious disease may have been introduced on transplant seedlings and appears to be the first time it has been reported in Oregon.

INSECT CONDITIONS

DEFOLIATORS

Western spruce budworm, *Choristoneura occidentalis*, Free. Visible defoliation caused by the western spruce budworm in Washington and Oregon decreased dramatically from 1.2 million acres in 1977 to 0.2 million acres in 1978. The amount of defoliation observed on the North Cascades National Park, Okanogan and Wenatchee National Forests, and adjacent state and private lands declined. No visible defoliation was observed on the Colville and Yakima Indian Reservations in Washington. However, poor weather conditions in Washington during the aerial survey made it difficult to detect the extent of defoliation. The budworm infestation on the Warm Springs Indian Reservation in Oregon decreased in size and intensity. A summary of budworm defoliation for 1977 and 1978 is presented in Table 1.

Table 1. — Summary of visible western spruce budworm caused defoliation in Oregon and Washington 1977-1978.

Reporting Area	1977 Defoliation (Acres)	1978 Defoliation (Acres)
Oregon		
Warm Springs Indian Reservation	18,890	5,980
TOTAL OREGON	18,890	5,980
Washington		
Okanogan Area		
National Forest Lands[1]	234,050	92,710
National Forest Dedicated Lands[2]	10,340	4,050
Bureau of Land Management	170	0
State and Private Lands	24,560	10,150
TOTAL OKANOGAN AREA	269,120	106,910
Wenatchee Area		
National Forest Lands[1]	424,620	49,020
National Forest Dedicated Lands[2]	94,130	170
Bureau of Land Management	0	0
State and Private Lands	274,760	12,930
TOTAL WENATCHEE AREA	793,510	62,120
North Cascades National Park	109,660	23,940
Colville Indian Reservation	910	0
Yakima Indian Reservation	2,620	0
TOTAL WASHINGTON	1,175,820	192,970
REGIONAL TOTALS		
National Forests	763,140	145,950
National Parks	109,660	23,940
Bureau of Land Management	170	0
Indian Reservations	22,420	5,980
State and Private (Oregon)	0	0
State and Private (Washington)	299,320	23,080
GRAND TOTAL	1,194,710	198,950

[1] Excluding wilderness areas.
[2] Wilderness area.

No suppression projects were carried out against spruce budworm populations in the Region in 1978.

In the fall of 1978, tree branches cut from trees within the defoliated area were examined for the presence of egg masses. The size and number of egg masses found enable entomologists to evaluate the potential for continued defoliation in 1979. Results indicate populations of western spruce budworm are down in most areas except on the Warm Springs Indian Reservation and on a few areas of the Okanogan National Forest and nearby state and private lands.

Modoc budworm, *Choristoneura viridis*, Free. The infestation on the Fremont National Forest and adjacent private lands caused no defoliation visible from the air in 1978.

Douglas-fir tussock moth, *Orgyia pseudotsugata*, Mcd. Defoliation caused by this insect was detected on 10,080 acres of private land in south-central Oregon in 1978. Pheromone traps were hung in the area in late summer. Very few males were caught, indicating that the population collapsed before reaching the adult stage. Larval collections, rearings and field examinations indicate that virus infection and pupal parasites were major contributors to the collapse.

Elsewhere, individual larvae were recovered from defoliator monitoring plots on the Deschutes, Winema, Ochoco, and Malheur National Forests in southern and eastern Oregon and the Colville Indian Reservation in north-central Washington indicating that the population in these areas needs to be monitored closely. Low level populations continued to decrease for the eighth consecutive year at Mare's Egg Spring on the northwest side of upper Klamath Lake on the Winema National Forest.

Sawfly, *Neodiprion nanulus contortae*, Ross. The 1978 aerial survey showed 3,060 acres of lodgepole pine lightly defoliated by this insect; 1,590 acres on the Deschutes, 240 acres on the Umpqua and 1,230 acres on the Winema National Forests in Oregon. An additional 4,000 acres of defoliation was observed from the ground on private land near Antelope Desert, Winema National Forest. No defoliation caused by this insect was found in Washington. Defoliation caused by this insect usually results in a short-term growth loss. Outbreaks of sawflies are usually of short duration, and these populations are expected to decline in 1979.

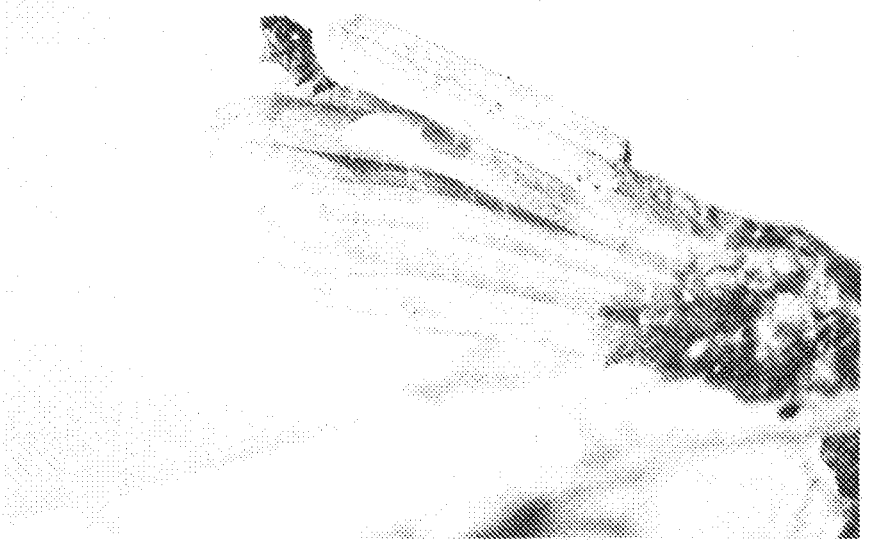


Photo #1. — Larch casebearer larvae in larch needle.

Larch casebearer, *Coleophora laricella*, (Hbn.). Populations of larch casebearer continue to defoliate western larch stands in eastern Washington and Oregon. Ground surveys show that the larch casebearer is present throughout the larch type in both States. No tree mortality has been observed in

areas that have been defoliated annually for the past 19 years. The only damage that has been reported is a loss in growth, particularly height growth

Several species of introduced parasites of larch casebearer were collected from release plots in Oregon and Washington in 1978. Dr. Roger Ryan, Pacific Northwest Forest and Range Experiment Station, reports that *Agathis pumila* (Ratz.) and *Chrysocharis laricinellae* (Ratz.) are now considered to be established in northeast Washington and northeast Oregon. In 1978 Boise Cascade Corporation and Kinzua Corporation participated in the release of *C. laricinellae* (Ratz.) and *A. pumila* in Oregon. It is felt that *C. laricinellae* will continue to spread and increase within the next few years, and in so doing, will aid *A. pumila* in reducing casebearer populations.

Larch budmoth, *Zeiraphera improbana* (Walker). Defoliation caused by this insect decreased from 28,350 acres in 1977 to 13,620 acres in 1978 in Washington. All of the damage occurred on the Wenatchee National Forest where light defoliation was found on 10,950 acres and moderate defoliation on 2,670 acres. The infestation on the Colville National Forest did not cause any defoliation visible from the air. Since this insect feeds only on current year's needles, the defoliation results in loss of tree vigor and growth. No defoliation was found in Oregon.

BARK BEETLES

The 1978 bark beetle losses in Oregon and Washington are summarized in Table 2.

Table 2. — Summary of 1978 bark beetle infestations by ownerships in Oregon and Washington (excluding Ips)

Insect Species	Forest Service (Com. For. Lands)		Other Federal (BLM & BIA)		Dedicated Lands (Wild. & Nat. Parks)		State and Private Lands		Total All Forest Lands	
	Acres	MBF	Acres	MBF	Acres	MBF	Acres	MBF	Acres	MBF
Douglas-fir beetle, East Side DF	15,540	3,384.4	570	88.2	2,410	603.4	3,500	709.8	22,020	4,786.8
Douglas-fir beetle, West Side DF	4,860	900.2	650	178.7	560	140.3	1,720	519.3	7,790	1,738.5
Fir engraver	19,360	1,682.7	840	23.9	920	81.0	7,240	607.5	28,360	1,715.1
Flatheaded woodborer	570	7.1	4,430	39.9	0	0.0	8,360	92.3	13,360	139.3
Mtn. pine beetle, ponderosa pine	368,810	87,965.7	12,800	741.3	1,250	265.0	193,840	54,342.6	576,700	143,314.6
Mtn. pine beetle, sugar pine	910	60.4	910	78.7	110	2.8	570	85.3	2,500	227.2
Mtn. pine beetle, w. white pine	3,980	332.0	110	4.6	510	152.8	20	2.3	4,620	491.7
Mtn. pine beetle, lodgepole pine	1,003,490	110,530.5	3,370	177.7	31,860	2,675.9	160,460	16,938.4	1,199,180	130,322.5
Western pine beetle	193,600	13,976.3	4,080	197.7	1,080	76.5	27,950	2,272.5	227,710	16,523.0
Total Oregon	1,612,120	218,159.3	27,760	1,530.7	38,700	3,997.7	403,600	75,570.0	2,082,240	299,257.7
Douglas-fir beetle, East Side DF	8,100	1,457.7	1,040	306.8	2,800	1,956.9	3,820	608.0	15,760	4,229.4
Douglas-fir beetle, West Side DF	220	39.9	0	0.0	630	18.8	30	4.2	880	62.9
Douglas-fir engraver	0	0.0	0	0.0	0	0.0	80	0.6	80	0.6
Engelmann spruce beetle	2,130	466.3	0	0.0	4,560	2,288.8	20	1.3	6,710	2,756.4
Fir engraver	6,330	580.2	2,760	192.2	440	14.9	3,520	281.3	13,050	1,068.6
Mtn. pine beetle, ponderosa pine	12,780	265.2	16,000	327.6	430	7.0	23,650	764.3	52,860	1,364.1
Mtn. pine beetle, w. white pine	27,300	8,717.3	4,380	781.6	24,920	5,477.4	3,130	720.8	59,730	15,697.1
Mtn. pine beetle, lodgepole pine	3,050	852.1	2,140	79.5	1,520	76.0	4,520	239.1	13,460	1,246.7
Mtn. pine beetle, whitebark pine	1,190	81.2	0	0.0	0	0.0	0	0.0	1,190	81.2
Western pine beetle	3,050	187.7	8,740	682.9	0	0.0	3,430	179.3	14,220	1,049.9
Total Washington	66,380	12,647.6	35,060	2,270.6	35,300	9,829.8	42,200	2,798.9	178,940	27,556.9
Total for Region	1,678,500	230,806.9	62,820	3,801.3	74,000	13,837.5	445,860	78,368.9	2,261,180	325,814.6

Mountain pine beetle, *Dendroctonus ponderosae*, Hopk. The mountain pine beetle continues to cause considerable tree mortality in the Pacific Northwest.

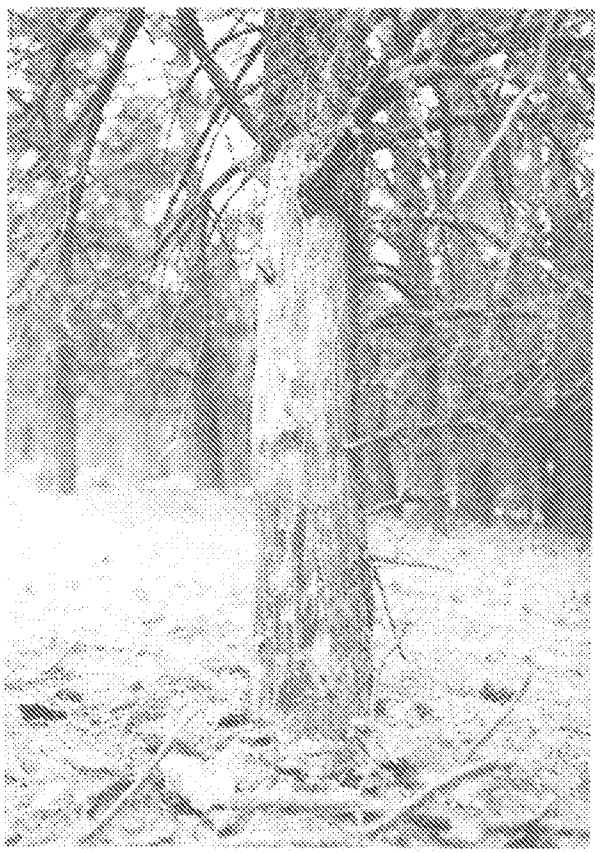


Photo #2. — Egg galleries of mountain pine beetle on ponderosa pine

Since 1970, this insect has killed an estimated 2.44 billion board feet of pine on 1.8 million acres in Oregon alone. Timber sales are in progress or being considered in many areas to utilize the material and rehabilitate the site. The largest outbreak is located on the Malheur, Umatilla, and Wallowa-Whitman National Forests and adjacent state and private lands in northeast Oregon. Mountain pine beetles in this area are attacking lodgepole pine and old and second-growth ponderosa pine. Losses in these lodgepole pine stands in 1978 are estimated at 119 million board feet on 1.07 million acres. The mountain pine beetle is still expanding into the remaining unmanaged stands of mature lodgepole pine; however, annual tree mortality in the older outbreak areas is starting to decline since most suitable host material has been killed. Losses in mature and immature ponderosa pine stands decreased within the outbreak area in 1978. Estimated losses of 142 million board feet of wood occurred on 540,180 acres this year. Greatest losses were observed in unmanaged second-growth ponderosa pine stands northeast of Prairie City and between Baker and La Grande, Oregon. Damage in mature ponderosa pine stands is most prominent on exposed, drier sites.

Elsewhere in the Region, mountain pine beetle caused heavy losses in lodgepole pine on 144,960 acres with 12.4 million board feet killed. In Oregon most of this loss occurred on the Deschutes, Fremont, and Winema National Forests and adjacent state and private lands. In Washington, most losses were observed on the Colville National Forest. In ponderosa pine, mountain pine beetle killed an estimated 28.2 million board feet on 89,380 acres on the Deschutes, Mt. Hood, Ochoco, and Winema National Forests and Warm Springs Indian Reservation in Oregon and the Okanogan, Wenatchee and Colville National Forest, Colville Indian Reservation, and state and private lands north of Spokane, Washington.

Mountain pine beetle losses in western white pine stands increased in Washington and decreased in Oregon in 1978. In Oregon, tree mortality was observed on the Mt. Hood, Umpqua, Deschutes, and Willamette National Forests. An estimated 491,000 board feet of timber were killed on 4,620 acres. In Washington, tree-killing occurred on the Wenatchee, Colville, Okanogan, and Olympic National Forests, Olympic National Park, and Yakima Indian Reservation. The estimated losses on these areas are 15.7 million board feet on nearly 60,000 acres.

Scattered killing of sugar pines was observed on the Willamette, Rogue River, Umpqua, and Winema National Forests and surrounding lands in Oregon. An estimated 203,100 board feet were killed by mountain pine beetles on 2,500 acres.

Western pine beetle, *Dendroctonus brevicomis, Lec.* Western pine beetle loses in mature ponderosa pine stands remained high throughout eastern Washington and increased to a higher level in Oregon in 1978. These high losses are believed to be a result of the 1976-1977 drought. Approximately 19.5 million board feet of ponderosa pine mortality were observed on 242,930 acreas in the Region. In Oregon, most losses occurred on the Deschutes, Fremont, Winema, Ochoco, and Malheur National Forests, Warm Springs Indian Reservation, and adjacent state and private lands. In Washington, most losses were on the Wenatchee National Forest and the Colville Indian Reservation. Timber and sanitation-salvage sales are in progress or being considered in most locations.

Douglas-fir beetle, *Dendroctonus pseudotsugae,* Hopk. Douglas-fir beetle activity declined in Oregon and Washington. Insect-killed trees totaled an estimated 10.8 million board feet on 46,450 acres in the Region. Most of the losses, or 7.7 million board feet, occurred on the Umatilla and Wallowa-Whitman National Forests, and adjacent State and private lands in eastern Oregon and

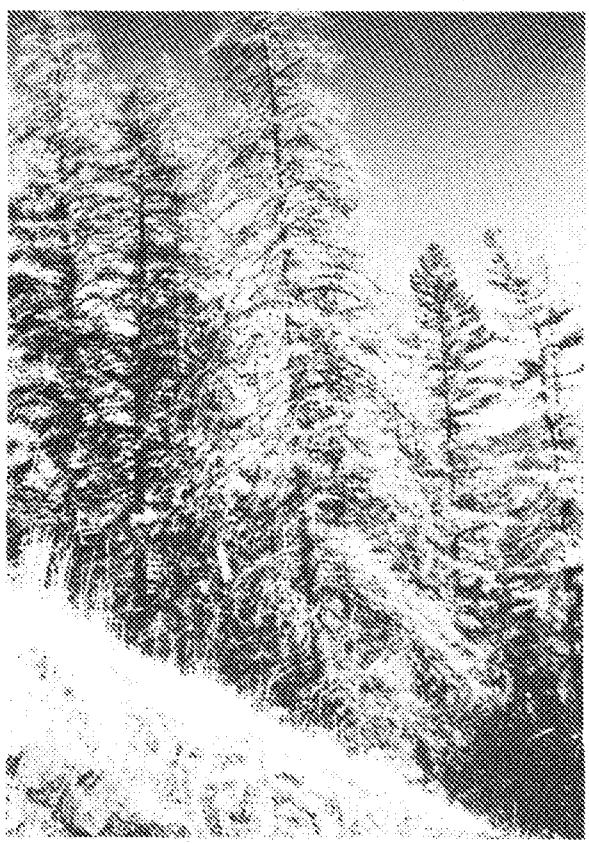


Photo #3. — Douglas-fir beetle-killed trees

Washington. Most of the loss is in areas that were defoliated heavily by the Douglas-fir tussock moth between 1972 and 1974. Elsewhere, scattered tree mortality was observed on the Rogue River, Siuslaw, Mt Hood, Siskiyou, Umpqua, and Willamette National Forests in western Oregon. In

Washington, losses were reported on the Gifford Pinchot and Olympic National Forests and the Olympic and North Cascades National Parks. Where feasible, timber and salvage sales are in progress or are being considered.

Pine engraver beetles, *Ips* spp. Tree mortality caused by these beetles increased in 1978. The 1976-77

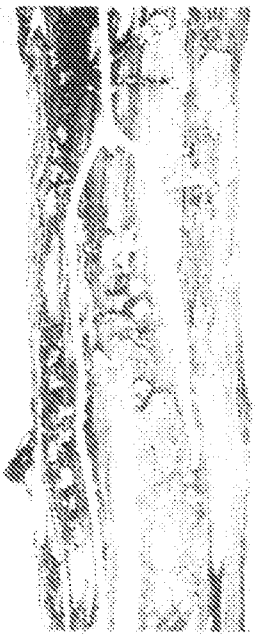


Photo #4. — Egg and larval galleries and pupal chambers of Ips pini on ponderosa pine

drought is believed to have weakened these trees, thus making them attractive to *Ips*. Damage was observed on approximately 345,000 acres in Oregon and Washington. Heaviest damage was reported on the Deschutes, Fremont, Wallowa-Whitman, Mt. Hood, and Umatilla National Forests and Warm Springs Indian Reservation in Oregon and on the Okanogan and Wenatchee National forests and Yakima Indian Reservation in Washington.

Photo #5. — Strip kill caused by the fir engraver Scolytus ventralis

Fir engraver, *Scolytus ventralis*, Lec. Damage from this beetle increased in Oregon and Washington. Losses in true fir stands are estimated at 2.8 million board feet on 41,405 acres. Most damage occurred in unmanaged stands on the Fremont, Winema, Malheur, Wallowa-Whitman, and Umatilla National Forests in Oregon and the Wenatchee and Colville National Forests in Washington.

Spruce beetle, *Dendroctonus rufipennis*, (Kby). Spruce beetle activity increased from 2,240 acres in 1977 to 6,710 acres in 1978. The reason for this increase is unknown. All of the losses, an estimated 2.75 million board feet, occurred in Washington on the Okanogan and Wenatchee National Forests.

OTHER INSECTS

Douglas-fir engraver, *Scolytus unispinosus* (Lec.). The Gifford Pinchot National Forest, Washington had the only reported activity in the Region, totaling 80 acres.

Flatheaded borers, *Melanophila* spp. It is believed that the drought of 1976 and 1977 resulted in these insects causing increased losses in Douglas-fir and ponderosa pine stands this year along the foothills around Medford and Grants Pass in southwest Oregon. Damage was detected on 13,360 acres in this area.

Spruce aphid, *Neomyzaphis abietina* (Walker). Cooler winter temperatures caused the infestation along the Oregon and Washington coasts to collapse. No visible defoliation was detected during the 1978 aerial survey in either Oregon or Washington.

Western oak looper, *Lambdina fiscellaria somniaria* Hulst. Populations of this pest declined in 1978. Moderate defoliation was found in Washington, Yamhill, and Polk Counties, Oregon.

During the summer of 1978, the PNW Experiment Station conducted a field test on 20 acres of two formulations of Thuricide,® a bacterium, *Bacillus thuringiensis*, against this insect. Some degree of insect population suppression along with foliage protection occurred. Since the oak looper is a subspecies of the hemlock looper, it is hoped that the treatment will be equally effective against the hemlock looper, should treatment of the latter be needed in the future.

Tent caterpillars, *Malacosoma* spp. Populations of this insect were observed defoliating alders and willows in Oregon along the Columbia River from Portland north to St. Helens. In southwest Washington, defoliation was reported on alder and other broadleaf trees.

Fall webworm, *Hyphantria cunea*, (Drury). Webworm population levels remained heavy in ornamental shade trees in Marion County, Oregon.

Gypsy Moth, *Porthetria dispar* (L.). Gypsy moth pheromone traps near Seattle this summer caught 22 male moths. An egg mass survey conducted this fall by the Animal and Plant health Inspection Service (APHIS) and the Washington State Department of Agriculture found 33 gypsy moth egg masses. Of the 33, 29 were destroyed and 4 were caged and left untreated to determine egg hatch for timing of an eradication project planned in the spring of 1979 by APHIS and the Washington State Department of Agriculture. This infestation is in a residential area where the gypsy moth is feeding on ornamental hardwood trees.

Black pine-leaf scale, *Aspidiotus californica*, Coleman. An increase in natural control agents has decreased the damage caused by this insect from 10,970 to 9,330 acres along the west edge of upper Klamath Lake in south-central Oregon. Some tree mortality, particularly in sugar pine, has occurred.

Balsam woolly aphid, *Adelges piceae*, (Ratz). Damage caused by this insect was observed on 5,930 acres of true fir stands in western Washington. A new infestation center was detected on state and

private lands in the Blue Mountains near the headwaters of the the Walla Walla River in Oregon. This center is approximately 15 miles southwest of the area where the balsam woolly aphid was discovered originally in 1974. Heavy populations were observed on subalpine fir, so it is believed that the insect has become established in recent years and could become a serious problem in true fir stands.

DISEASE CONDITIONS

ROOT DISEASES

Laminated root rot. *Phellinus weirii* (Murr.) Gilbertson, continued to be one of the most damaging root pathogens in the Northwest. A survey conducted in a 600-acre stand on the Siuslaw National Forest by Oregon State University showed 18 percent of the area to be out of commercial production due to laminated root rot. Regionwide, it is estimated that about 5 percent of the Douglas-fir type is affected by laminated root rot.

Armillaria root rot. *Armillaria mellea* (Vahl ex Fr.) Quel, continued to damage both westside plantations and eastside mature stands in 1978. Plots were established in Oregon and Washington to monitor

Photo #6. — Symptoms of armillaria root rot on ponderosa pine

the effects of precommercial thinning in Douglas-fir plantations infected with Armillaria. Several large disease centers caused by Armillaria were found on the Deschutes and Rogue River National Forests. The Washington State Department of Natural Resources is moving cautiously into direct control of Armillaria root rot by stump and root removal on State lands. A detailed management guide has been prepared for WDNR foresters.

Annosus root and butt rot. *Fomes annosus* (Fr.) Cke. was found causing decay in up to 30 percent of the western hemlock stems in rotation age (50-80 year) stands. More decay was found in thinned

Photo #7. — Dissecting Fomes annosus - infected western hemlock.

stands than in unthinned stands. More trees become infected through trunk wounds than spread from adjacent stumps. Butt rot, rather than tree mortality, was the principal type of damage. A University of Washington survey showed that an average of 38 percent of the trees in 21 unthinned western hemlock stands were infected by *F. annosus.* All stands sampled were infected. By the end of 1979, the impact of *F. annosus* in western hemlock should be well understood and management practices to reduce losses can be formulated.

Photo #8. — Ceratocystis (Verticicladiella) wageneri on mountain hemlock

Black stain root disease. *Ceratocystis (Verticicladiella) wageneri* (Kendrick) Goheen and Cobb, was

found in new areas in both Oregon and Washington in 1978. A large infection center covering 2-3 acres was found in a 40-year-old mixed hemlock-Douglas-fir stand near Forks, Washington, and numerous infection centers were discovered around Detroit, Oregon. Limited control of the disease by removing the infected Douglas-fir has been suggested. The hemlock appears to be uninfected. Spread rates of actively enlarging disease centers are being measured.

NEEDLE DISEASES

Lodgepole pine needle blight. *Lophodermella concolor* (Dear.) Dark, continued to kill foliage in lodgepole pine saplings in eastern Oregon and Washington. Because of the dry spring in 1977 which reduced germination of spores, the degree of infection in 1978 was less than in 1976 and 1977

Symptoms may reappear in 1979 because the moist spring this year may favor infection of current year's foliage. Effects on growth rates of affected trees are being measured.

Ponderosa pine needle blight. *Lophodermella morbida* Staley and Bynum, was examined in 26 plantations in southeast Oregon. This desease was severe in several areas planted with off-site pine. Many infected trees were killed by the disease.

Photo #9. — Lophodermella morbida - infected ponderosa pine

Larch needle diseases. *Hypodermella laricis* Tub and *Meria laricis* Vuille, were prevalent on western larch in northeast Washington due to moist spring conditions. *Meria laricis* was more abundant than *H. laricis*. These foliage diseases should do little damage to affected trees.

Pine needle cast. Scotch pine planted as Christmas trees in the Puget Sound area was severely infected by *Lophodermium pinastri* (Shrad. ex Hook) Chev. which caused foliage discoloration and

premature needlecast. Infection has increased dramatically over the last 10 years and appears to be worsening. The disease can be controlled with a fungicide.

Rhabdocline needlecast. Off-site Douglas-fir Christmas trees in the Puget Sound area suffered much higher levels of infection by *Rhabdocline pseudotsugae* Syd. and damage by frosts than trees grown from local seed sources.

Swiss needlecast. Increasing incidence of *Phaeocryptopus gaumanni* (Rohde) Petr. was observed in Douglas-fir Christmas tree plantations in the Puget Sound area and in noble fir plantations near Morton, Washington.

OTHER DISEASES

Maple foliage damage. The most spectacular forest disease of 1978 was the curling and browning of bigleaf maple foliage over the entire range of the tree. Causes of the overall tree browning, foliage discoloration, and premature leaf drop were the drought of 1977, heavy seed crops, and widespread infection by an anthracnose fungus, *Gloeosporium apocryptum*. It is not known if this maple malady will persist. Some degree of injury occurs nearly every year.

Hemlock dwarf mistletoe. Incidence of *Arceuthobium tsugense* (Rosendahl) Jones, was measured in 292 western hemlock plantations on Bureau of Land Management lands in Oregon. Only 20 plantations were classified as requiring treatment of residual trees and/or natural regeneration to prevent damage in the developing stands.

Indian paint fungus. A cooperative intensive survey of advanced regeneration of white fir on the Fremont National Forest by the Pacific Northwest Forest and Range Experiment Station and Forest Insect and Disease Management showed that 22 percent of all sampled trees were infected by *Echinodontium tinctorium* (Ell. and Ev.) Some trees had active decay but many contained dormant infections in sound wood.

Dogwood leaf blight. This blights, an anthracnose-like disease, caused by *Gloeosporium corni* was found in many westside dogwoods in Washington. It is characterized by brown and drooping leaves and flowers. Infection develops from the top of the crown downward. The disease causes a loss of current flowers and leaves and branch dieback. Damp and cool weather in May contributed to the spread of the disease in 1978.

Dutch elm disease. Walla Walla is still the only confirmed location of Dutch elm disease caused by *Ceratocystis ulmi* (Buism.) C. Mor., in Washington. There have been no new findings in the city of Portland where one diseased tree was found and removed in 1977. Portland has initiated a program to protect elms in the city by removing elm bark beetle breeding sites and spraying to prevent beetle attacks.

Charcoal root disease. *Macrophomina phaseoli* (Maub.) Ashby, was discovered on symptomatic Douglas-fir seedlings in a nursery at Umpqua, Oregon. It appears that the disease may have been introduced into the nursery on transplant seedlings. This potentially serious disease has been reported in several California nurseries, but apparently this is the first Oregon report. Evaluations of this disease are continuing.

Phytophthora root disease of Douglas-fir seedlings. In 1974 Phytophthora root rots were detected on Douglas-fir seedlings in several nurseries in Oregon. Five species of Phytophthoras were isolated from dead and dying roots. Four of the five had never previously been reported on Douglas-fir seed-

lings. Survival of outplanted infected seedlings was poorer than that of healthy seedlings. Pathologists at Oregon State University were asked to conduct research on the Phytophthoras to determine their pathogenicity and potential of survival and spread on forest sites and to test survival of infected trees. This research was completed in 1978. Although the Phytophthoras could still be recovered from roots of infected seedlings 2 years after outplanting, the fungi did not spread from roots in infected seedlings. Initially, infected seedlings had poorer survival than healthy trees. Infected trees which survived the initial period of mortality regenerated new roots above the level of infection and have proceeded to grow normally. It was concluded the Phytophthoras do not constitute a serious threat to Douglas-fir reforestation efforts. Recommendations were made to reduce infection in nurseries by avoiding planting in excessively wet soils, reducing internursery movement of seedlings, and improving sanitation practices. Techniques were developed for isolation of the Phytophthoras from seedlings.

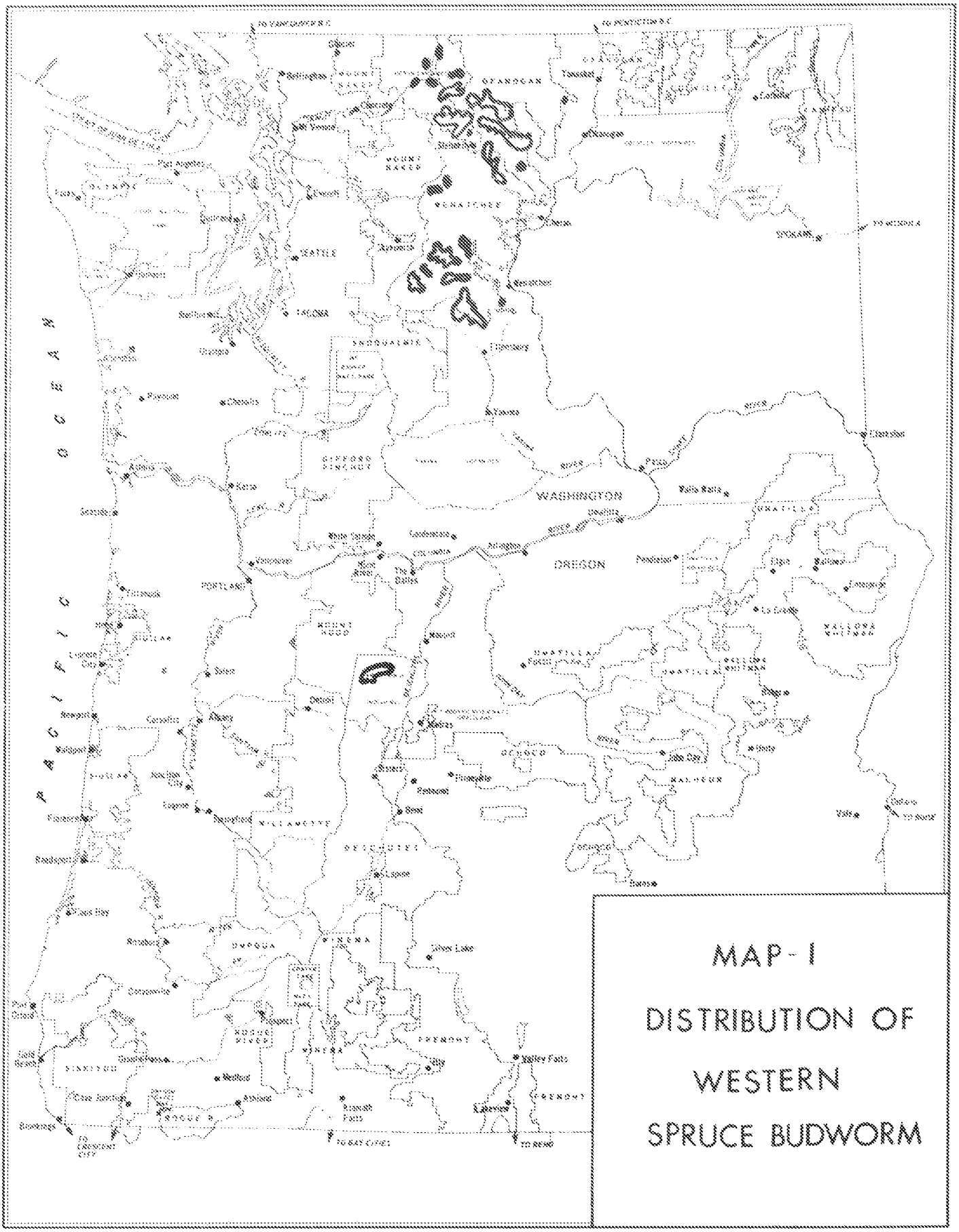
CLIMATOLOGICAL INJURIES

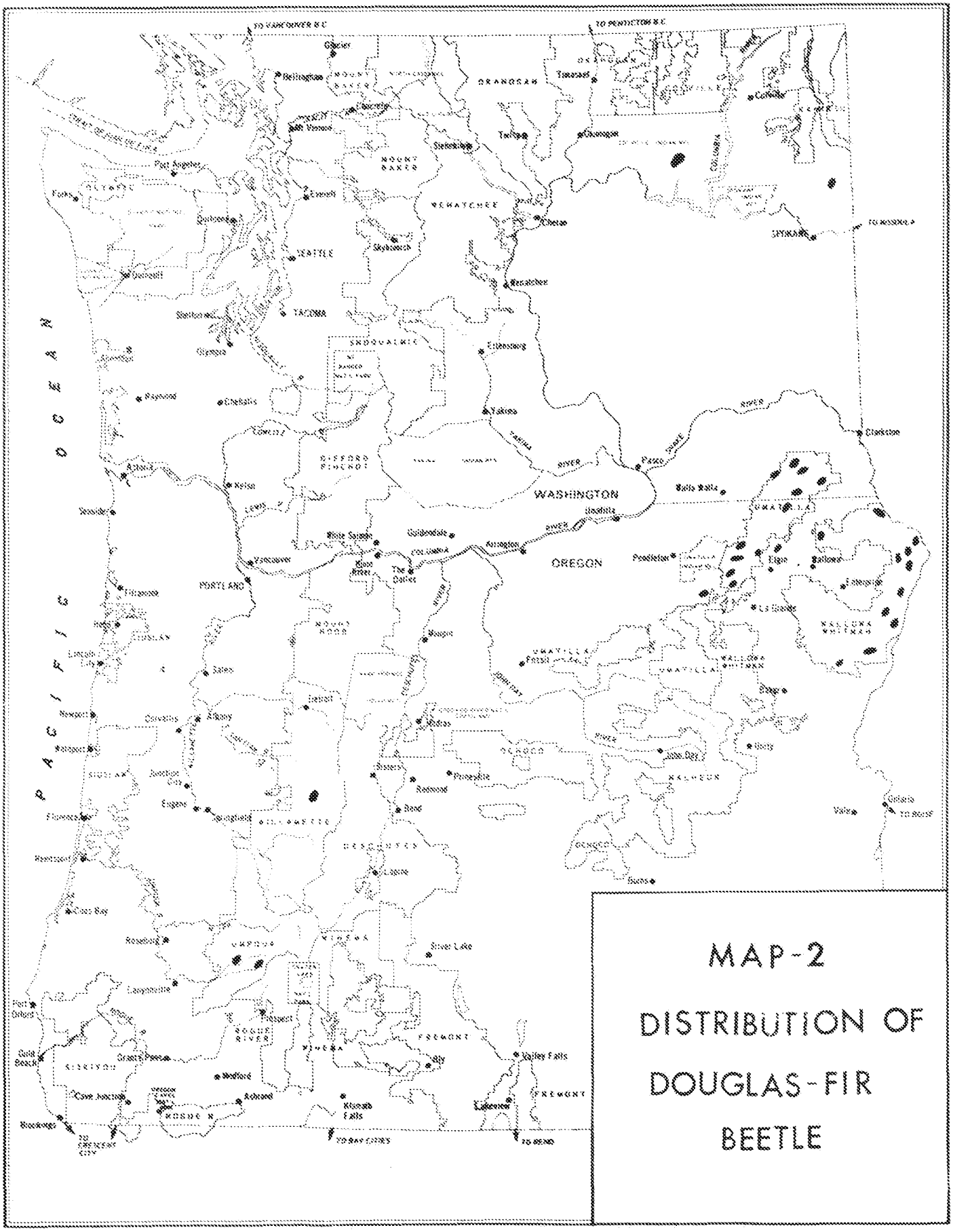
Drought damage. Drought damage reappeared in hardwoods even though normal precipitation returned in 1978. Drought damage should subside as normal precipitation continues in subsequent years. A small amount of winter freeze top-kill, a form of drought injury, was noted in scattered Douglas fir growing in open areas around the Puget Sound lowlands.

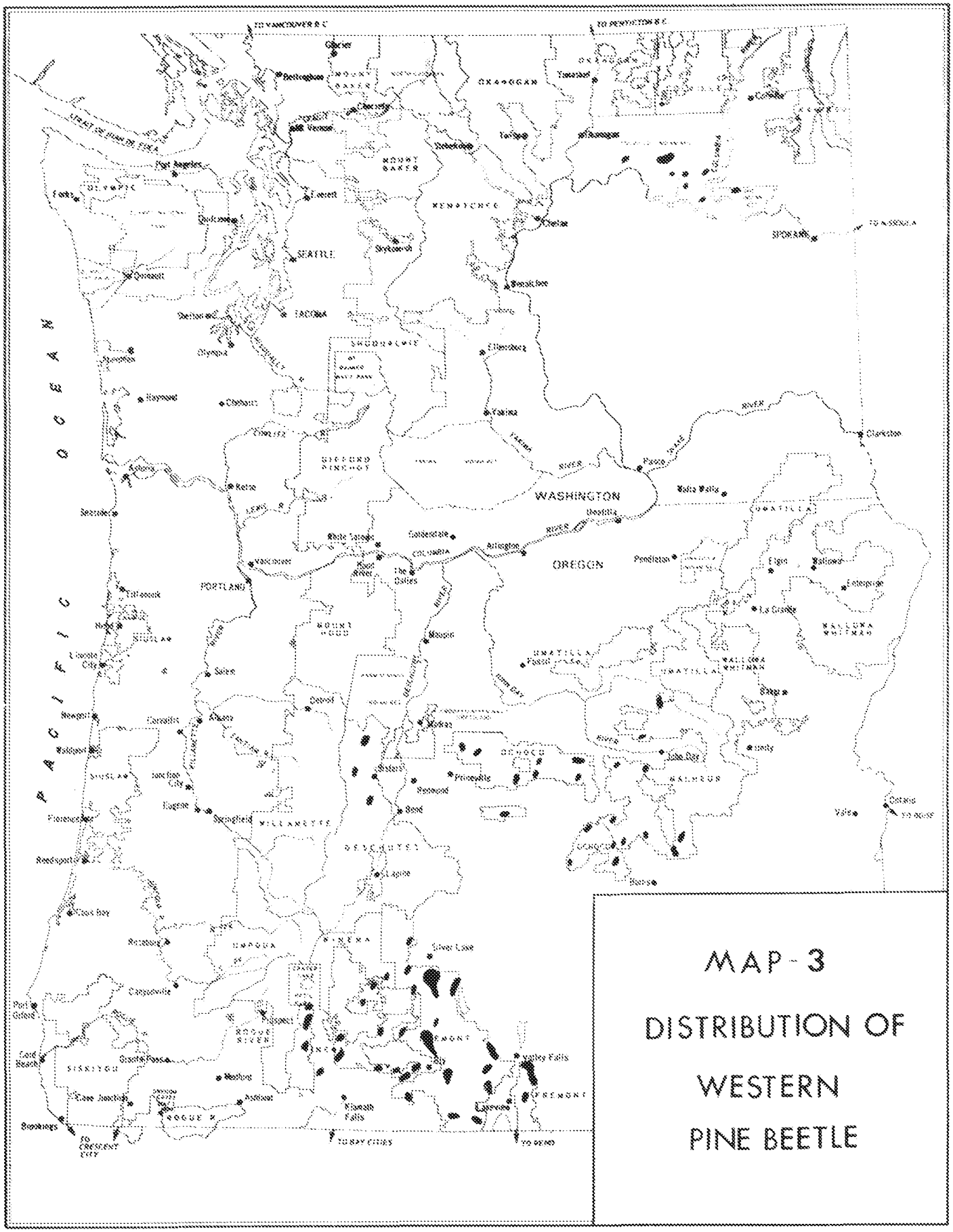
APPENDIX

MAPS

1. Distribution of Western Spruce Budworm
2. Distribution of Douglas-Fir Beetle
3. Distribution of Western Pine Beetle
4. Distribution of Mountain Pine Beetle in Lodgepole Pine
5. Distribution of Mountain Pine Beetle in Ponderosa Pine
6. Disease Survey Areas
7. Disease Occurrences

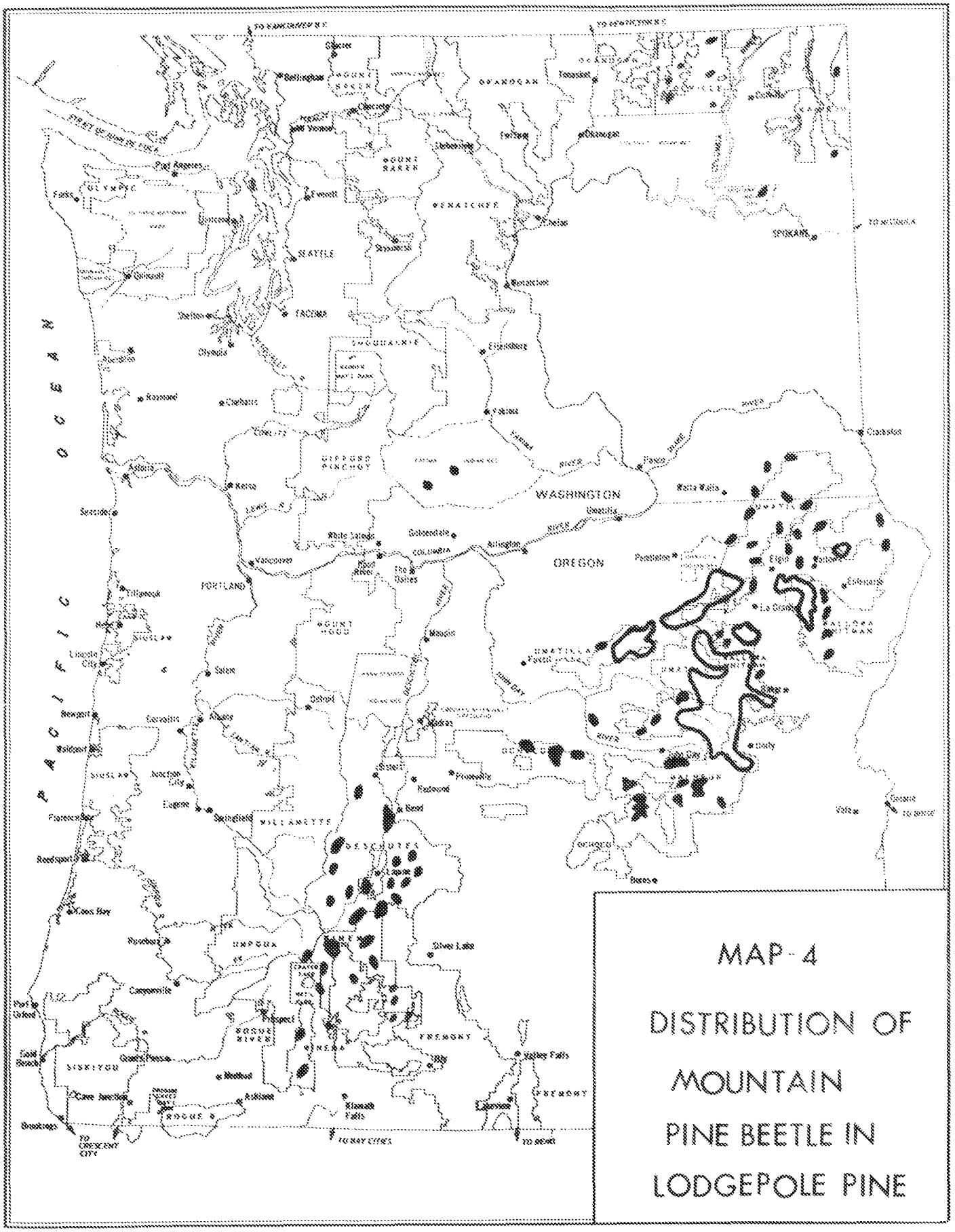

PACIFIC OCEAN
WASHINGTON
OREGON
SEATTLE
PORTLAND
SPOKANE
MAP - I
DISTRIBUTION OF
WESTERN
SPRUCE BUDWORM


PACIFIC OCEAN
WASHINGTON
OREGON
PORTLAND
SEATTLE
TACOMA
SPOKANE
MOUNT BAKER
WENATCHEE
OKANOGAN
SNOQUALMIE
OKANOGAN
COLVILLE
GIFFORD PINCHOT
MOUNT HOOD
WILLAMETTE
DESCHUTES
UMPQUA
ROGUE RIVER
SISKIYOU
FREMONT
WINEMA
KLAMATH
MALHEUR
UMATILLA
WALLOWA WHITMAN
BLUE MOUNTAINS
TO VANCOUVER B.C.
TO PENTICTON B.C.
TO BEND
TO BAY CITIES
MAP-2
DISTRIBUTION OF
DOUGLAS-FIR
BEETLE



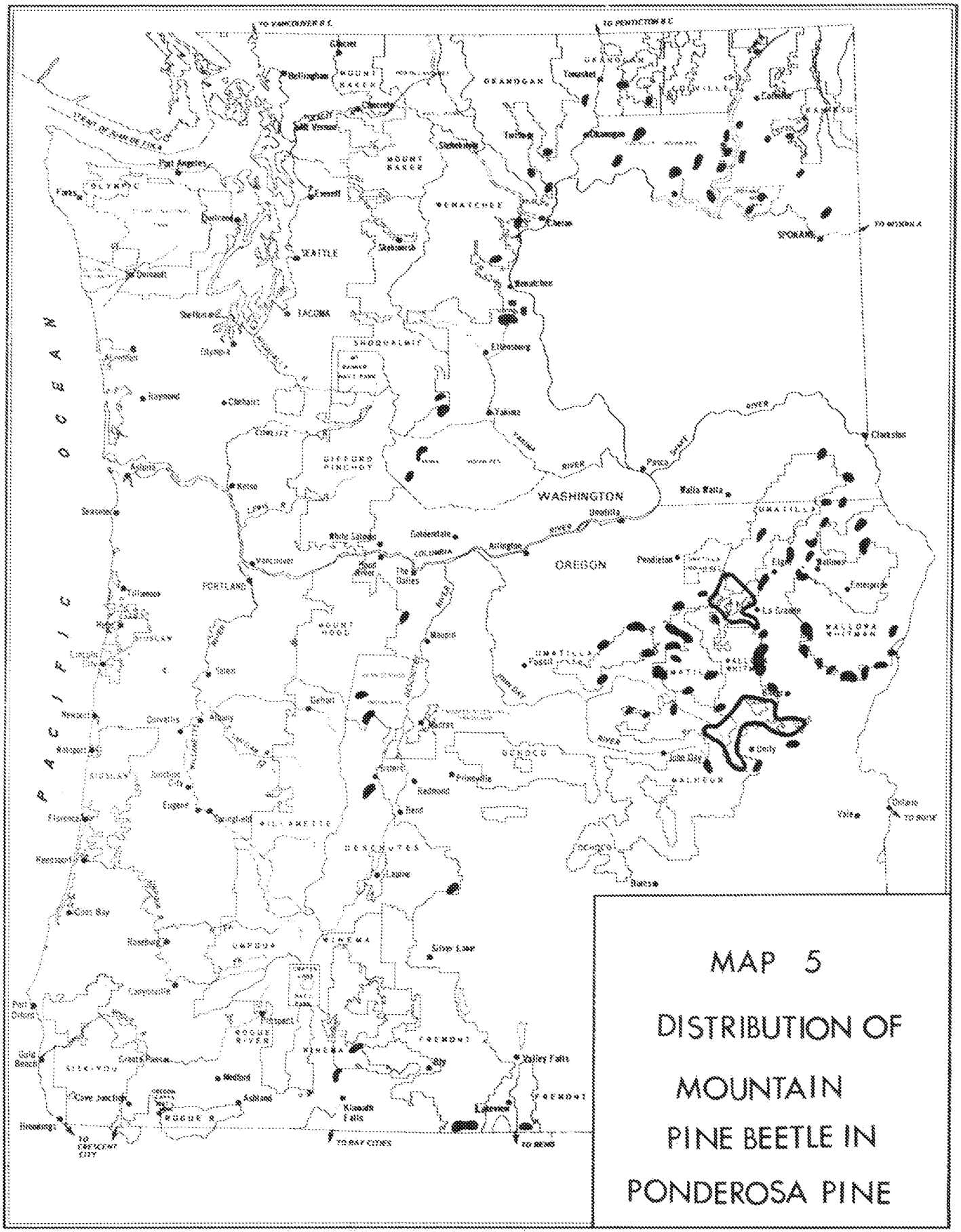
MAP - 3

DISTRIBUTION OF WESTERN PINE BEETLE



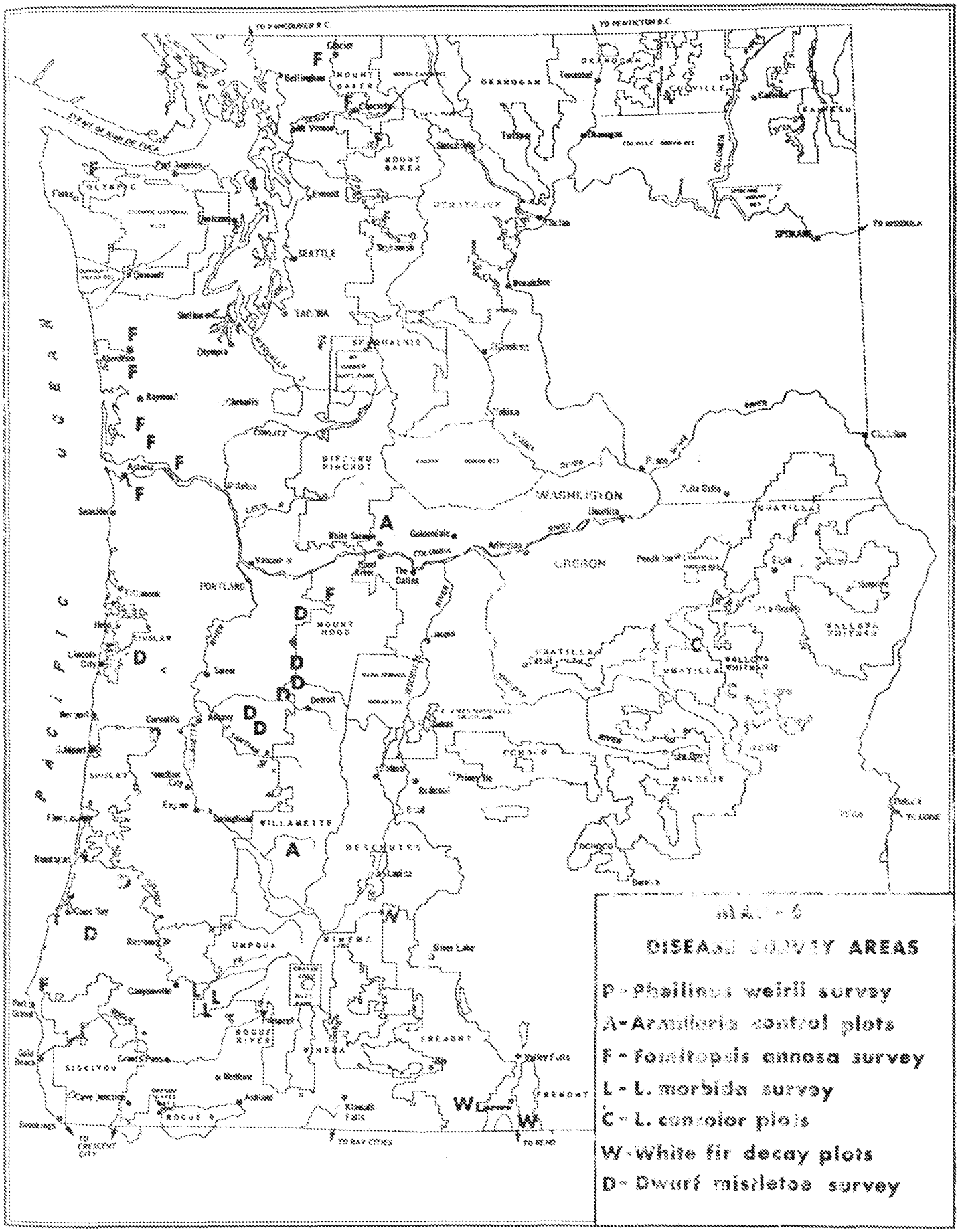
MAP - 4

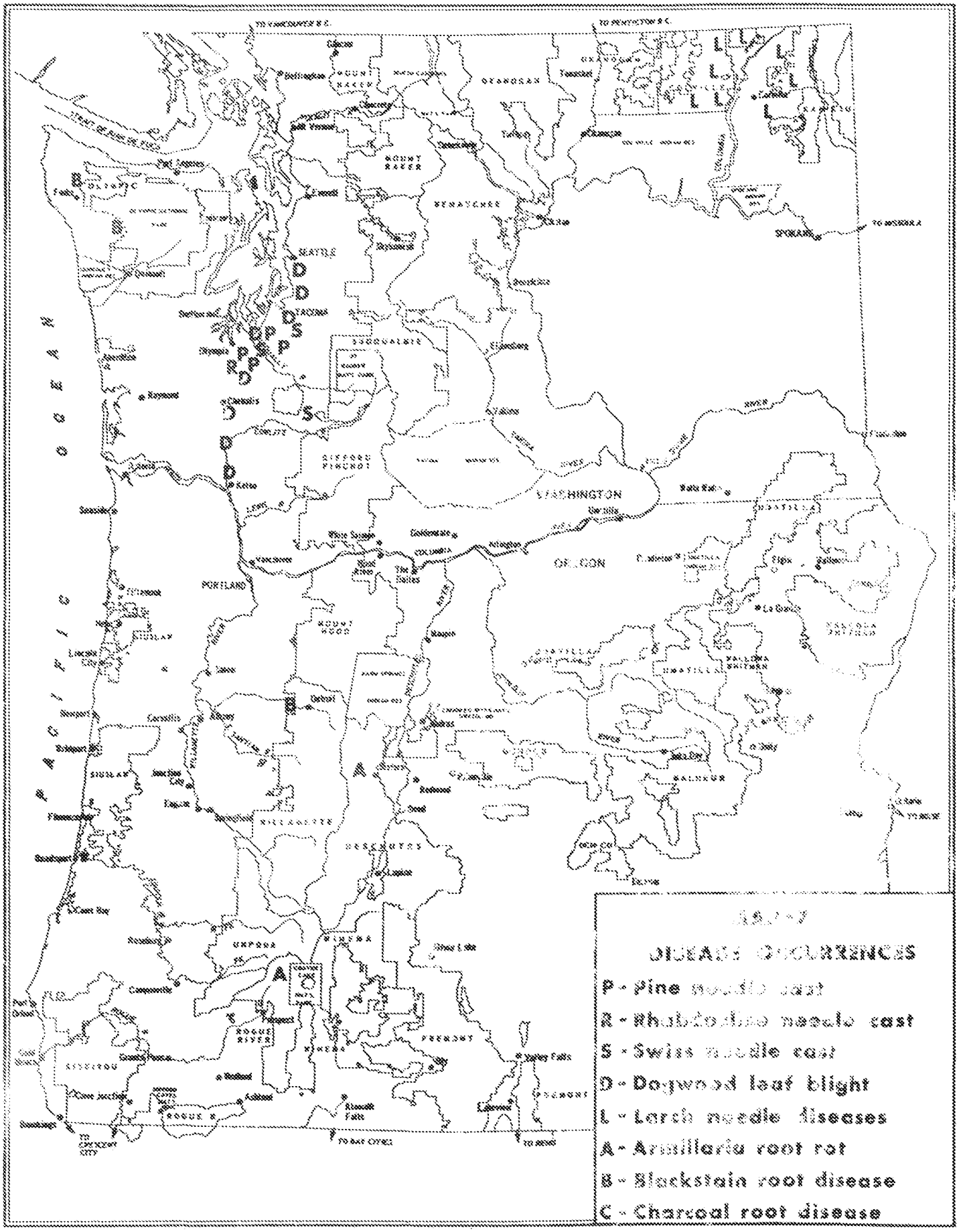
DISTRIBUTION OF MOUNTAIN PINE BEETLE IN LODGEPOLE PINE



MAP 5

DISTRIBUTION OF MOUNTAIN PINE BEETLE IN PONDEROSA PINE


MAP - 6
DISEASE SURVEY AREAS
P - Phellinus weirii survey
A - Armillaria control plots
F - Fomitopsis annosa survey
L - L. morbida survey
C - L. concolor plots
W - White fir decay plots
D - Dwarf mistletoe survey
PACIFIC OCEAN
WASHINGTON
OREGON
MOUNT BAKER
OKANOGAN
OLYMPIC
SEATTLE
TACOMA
PORTLAND
WILLAMETTE
DESCHUTES
UMPQUA
ROGUE RIVER
SISKIYOU
CRESCENT
COLUMBIA
YAKIMA
WENATCHEE
OKANOGAN
COLVILLE
GIFFORD PINCHOT
MOUNT HOOD
ROGUE R.
TO VANCOUVER B.C.
TO PENTICTON B.C.
TO OREGON
TO IDAHO



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